Applicant note with appreciation the continued indication of allowability with regard to claims 11-13, 15, 16 and 22.

Claim 9 stands rejected under 35 U.S.C. §112, first paragraph, containing subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. Accordingly, applicant has cancelled claim 9. Thus, it is respectfully submitted that the rejection is now moot and it is respectfully requested that the rejection be withdrawn.

Claims 3-7 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that applicant regards as the invention. The Examiner pointed out that these claims depended upon cancelled claim 2. Accordingly, applicant has amended the claims so that they now depend from claim 1. Thus, it is respectfully submitted that the rejection is now moot and it is respectfully requested that the rejection be withdrawn.

Claims 1, 4, 8, 9, 10 and 14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Nichols and Lyman.

Claims 1, 3, 4, 5, 8, 10 and 14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Shimamoto and Scheller (U.S. Patent No. 4,668,885).

Claims 6 and 7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Shimamoto and Scheller in further view of Machino.

Claims 17-19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Nichols and Lyman, in further view of German patent 945,183.

Claims 20 and 21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Nichols and Lyman, in further view of Schoeb.

These rejections are respectfully traversed and reconsideration is respectfully requested.

Applicant notes that the present Office Action was indicated as final on the Office Action Summary sheet. However, applicant believes that this was an error since this is an Office Action in response to a properly filed continuing prosecution application. Indeed, some of the rejections even included a newly cited reference (specifically, Scheller, U.S. Patent

No. 4,668,885). Accordingly, it is respectfully requested that the finality of the rejections in the Office Action mailed October 6, 2000, be withdrawn.

The Present Invention

The present invention relates to a magnetic bearing with an integrated rotational drive having a substantially disk- or ring-shaped rotor, wherein the rotor generates a unipolar bias magnetization flux. There are two different functions, namely the magnetic bearing function and the electromagnetic drive function. To accomplish both functions, one has to take into consideration two opposing requirements. Firstly, for the bearing function, it is desirable that the unipolar magnetic bias flux is as homogeneous as possible when viewed in the circumferential direction of the rotor. Secondly, for the driving function, it is necessary that the unipolar bias flux be inhomogeneous, i.e., spatially modulated, when viewed in the circumferential direction. Otherwise, it is not possible to generate a torque in the rotor by means of a rotary or alternating field.

Thus, throughout this amendment, the wording "inhomogeneous flux" will be used with the meaning that the unipolar biased magnetic flux is spatially modulated with respect to the circumferential direction of the rotor, and the wording "homogeneous flux" with the meaning that the bias flux is spatially constant in the circumferential direction of the rotor.

It is important for one to realize that, for the bearing function, the unipolar biased flux should be homogeneous along the whole circumference of the rotor because a clogging problem arises if such is not the case. On the other hand, for the driving function, the bias flux must be inhomogeneous because otherwise one cannot generate a torque in the rotor by means of a rotary or alternating field.

The Section 103 Rejection Over Nichols In View Of Lyman

With regard to claim 1, the Examiner contends that Nichols would disclose the claimed invention except for the permanent magnets distributedly arranged on the rotor and since permanent magnets on the rotor are known from Lyman, it would have been obvious to construct the Nichols system with permanent magnets on the rotor.

Applicant respectfully submits that it is not a question whether it is obvious to arrange permanent magnets on the rotor per se, but whether it is obvious to generate the inhomogeneous unipolar bias magnetic flux by means provided on the rotor, wherein the means comprise permanent magnets that are distributedly arranged on the rotor.

According to Nichols, the biased magnetic flux is generated in the stator and the inhomogeneity of the biased magnetic flux, i.e., its spatial modulation, is achieved by means of the geometric design of the rotor, which is a so-called reluctance rotor having radially outwardly protruding flanges. In Nichols, there is no hint whatsoever to generate the inhomogeneous bias magnetic flux by permanent magnets on the rotor.

On the other hand, Lyman's patent relates to a magnetic suspension apparatus, i.e., a magnetic bearing. As mentioned above, for the magnetic bearing function, it is desirable to make the biased magnetic flux as homogeneous as possible, and that is exactly the concern of Lyman. Lyman wants to make the bias flux as homogeneous as possible. For example, in column 1, lines 41-42, Lyman states that he wants to avoid "excessive drag from eddy currents induced in the rotor." Since eddy currents produce additional magnetic flux that disturbs the homogeneity of the bias flux, such eddy currents should be avoided. In addition, in column 3, lines 37-42, Lyman clearly states that the change of flux shall be minimized. Furthermore, in column 5, lines 45-46, Lyman teaches that the unbalance of the contribution of the permanent magnets (that is nothing else than a inhomogeneity of the biased magnetic flux) is adverse, and in column 5, lines 63-66, Lyman states that the net unbalanced contribution of the permanent magnets and the field strength (flux) induced thereby at the periphery of the stator shall be compensated. Even more clearly, in column 6, lines 32-40, Lyman teaches that the magnetic field strength at any point around the periphery of the stator and rotor (the field strength across the gap therebetween) is substantially equal to the field strength in any other location around the periphery, which means that the field strength is homogeneous along the circumference of the rotor.

Thus, in conclusion, it may be said that Lyman unambiguously teaches to make the magnetic flux as homogeneous as possible.

On the other hand, in the integrated magnetic levitation and rotation system disclosed by Nichols, there has to be an inhomogeneity of the bias magnetic flux because

otherwise there could not be an interaction with a rotating field that generates a driving torque in the rotor. Consequently, the teaching of Nichols and Lyman are opposing to each other and therefore, there is no motivation for one skilled in the art to combine the two references.

But even if one were to combine Nichols with Lyman, this would not result in the claimed invention. Of course, Lyman discloses to provide permanent magnets on the rotor, but arranging the permanent magnets on the rotor such that they generate an inhomogeneous unipolar bias magnetic flux is in clear contradiction to the teaching of Lyman. Accordingly, it is respectfully submitted that the argumentation of the Examiner in the "Response to Arguments" is based on the knowledge of the present invention. It is respectfully submitted that the Examiner has simply picked out one special feature of the disclosure of Lyman, namely to provide permanent magnets on the rotor, and completely neglected the unambiguous teaching of Lyman to make the magnetic flux as homogeneous as possible.

In addition, Nichols himself teaches away from the idea to generate an inhomogeneous bias flux by means of permanent magnets on the rotor. Nichols emphasizes, for example on page 11, at lines 3-5, that the air gap between the stator and the rotor shall be minimized. If one were to look, for example, to Figs. 9, 10 or 11 of the present application, one would see that providing the permanent magnets on the rotor is equivalent to increasing the air gap between the rotor and the stator for the bearing magnetic flux. Permanent magnets typically have a magnetic permeability that is quite close to 1 (the value for air). Accordingly, in a closed magnetic path, a permanent magnet behaves like an air gap with respect to the conduction of magnetic flux. Thus, providing the permanent magnets on the rotor as shown, for example, in Figs. 9, 10 and 11, is equivalent to increasing the air gap between rotor and stator. Since Nichols teaches to minimize the air gap, it is respectfully submitted that he teaches away from the subject matter of the present invention.

Accordingly, it respectfully submitted that one skilled in the art would not be motivated to combine the teachings of Nichols and Lyman in order to arrive at the present invention as recited in claim 1. Accordingly, it is respectfully submitted that claim 1 is allowable.

Claims 3-10, 14 and 17-21 depend, either directly or indirectly, on claim 1 and therefore they are allowable for at least the reasons claim 1 is allowable. These claims further define and augment features of applicant's invention.

The Section 103 Rejection Over Shimamoto In View of Scheller

It is respectfully submitted that Shimamoto does not propose to generate an inhomogeneous unipolar bias magnetic flux. Shimamoto provides separate drive means, both in the rotor and in the stator for driving the rotor.

It is also respectfully submitted that Scheller does not remedy this deficiency. As the Examiner correctly points out in the Office Action, "Scheller teaches a plurality of spatially modulated magnets 10 are equivalent to an annular ring magnet." But it is respectfully submitted that an annular ring magnet unambiguously generates a homogeneous bias flux. Accordingly, there is absolutely no disclosure or any suggestion in Scheller to generate an inhomogeneous bias flux by means of permanent magnets arranged on the rotor.

Although Scheller discloses a passive magnetic bearing (as opposed to an active magnetic bearing), essentially the same as explained above with respect to Lyman holds for Scheller also. The magnetic flux generated by the rotor shall be homogeneous when viewed in the circumferential direction of the rotor because otherwise the unbalanced magnetic forces acting upon the rotor will try to tilt the rotor.

By providing a ring-shaped array of discrete bar magnets (see column 2, lines 54-55) on the rotor 6 (or the "stator" 2), Scheller wants to simulate a large homogeneous annular permanent magnet. The reason for this given at column 2, lines 55-57: "These bar magnets are relatively simple and inexpensive to manufacture and obviate the need to magnetize large ring magnets." Indeed, the ring-shaped array of discrete bar magnets is essentially equivalent to a large ring-shaped permanent magnet and therefore unambiguously generates a homogeneous magnetic flux when viewed in a circumferential direction of the rotor.

To improve the homogeneity of the magnetic flux, Scheller even proposes that the individual bar magnets 10 (see Fig. 2) rest against the radially interior side of a soft iron ring 11 that has the shape of a cylindrical section (see column 3, lines 62-66). This soft iron

ring 11 surrounding the individual bar magnets clearly has the function to make the magnetic flux of the rotor as homogeneous as possible along with circumference of the rotor. Thus, even if one skilled in the art were to combine Shimamoto with Scheller, there is neither any disclosure nor any suggestion that the rotor has means that generate a unipolar biased magnetic flux that is spatially modulated when viewed in a circumferential direction. To the contrary, both documents clearly teach to make the magnetic flux of the rotor homogeneous with respect to the circumferential direction of the rotor.

Accordingly, since neither Shimamoto nor Scheller, neither alone nor in combination, teach, disclose or suggest a magnetically journalled rotational arrangement as recited in claim 1, claim 1 is allowable.

Claims 3-10, 14 and 17-21 depend, either directly or indirectly, on claim 1 and therefore, they are allowable for at least the reasons that claim 1 is allowable.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is urged. If the Examiner believes a telephone conference would aid in the prosecution of this case in any way, please call the undersigned at 415-576-0200.

Respectfully submitted,

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